

least one of the illumination optical system and the projection optical system, the optical components comprising at least one lens; and

mutually communicating, using a plurality of passage means, spaces separated by the optical components, for assisting in gas purging by the gas purging means,

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wherein a straight line connecting an adjacent pair of said plurality of passage means provided in [the] a same casing for gas purging, is not parallel to a plane defined by an optical axis of said [the] at least one lens and a straight line connecting another adjacent pair of said plurality of passage means.

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 9 and 17 having been indicated as allowable, Claims 1-7, 10-12, 14-16 and 18 are now presented for examination. Claim 10 has been cancelled without prejudice to or disclaimer of its subject matter. Claims 1, 6, 14, 15, 16 and 18 have been amended to define still more clearly what Applicant regards as his invention, in terms which distinguish over the art

of record. Claims 1, 6, 14-16 and 18 are the only independent claims under consideration.

The drawings have been objected to in that the feature of "an aperture formed in said support" must be shown without the addition of new matter. This objection is respectfully traversed. Figs. 2 and 3 are believed to show clearly that apertures 32 in lens support 31 which, as disclosed from line 24 of page 14 to line 1 of page 15, provide purging air passages. Accordingly, it is believed that the feature of "an aperture formed in said support" is supported in the drawings.

Claims 6, 7 and 16 have been rejected under 35 U.S.C. § 112, first paragraph in that the specification lacks adequate support for the recitation of the passage means comprising an aperture formed in the support. This rejection is respectfully traversed. The objected-to recitation is clearly supported at least from line 24 of page 14 to line 1 of page 15 with reference to Figs. 2 and 3 in the disclosure of a lens support 31 which has openings 32 therein that function to provide purging air passages. Accordingly, Claims 6, 7 and 16 as presented in this amendment are believed to comply with the requirements of 35 U.S.C. § 112, first paragraph.

Claims 1, 6, 7 and 15 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

Claims 1 and 15 have been objected to in that the term "substantially" renders the claims indefinite since the specification does not provide metes and bounds of "substantially" as a term of degree.

In Claim 1 as amended by this amendment, the recitation "gas purging means for replacing an inside space, which contains optical components of at least one of said illumination optical system and said projection optical system, with a gas having substantially no water content" has been changed to "gas purging means for replacing an inside space, which accommodates optical components of at least one of said illumination optical system and said projection optical system, with a dry gas". In Claim 15 as amended by this amendment, the recitation "replacing, using gas purging means, an inside space, which contains optical components of at least one of the illumination optical system and the projection optical system, with a gas having substantially no water content" has been changed to "replacing, using gas purging means, an inside space, which accommodates optical components of at least one of the illumination optical system and the projection optical system, with a dry gas". Accordingly, the objected-to term "substantially" has been deleted.

Claims 6 and 7 have been objected to in that it is unclear as to what "an aperture formed in said support" refers

to. Claim 6 recites "a support for supporting said at least one lens" and "an aperture formed in said support". These recitations are believed to be sufficiently disclosed in the specification at least from line 24 of page 14 to line 1 of page 15 with reference to element 31 in Figs. 2 and 3 for one skilled in the art to readily understand.

Claim 14 at line 15 and Claim 18 at line 16 have been objected to as lacking an antecedent basis for "the same casing". Claim 14 has been amended by this amendment to recite "a straight line connecting an adjacent pair of said plurality of passage means provided in a same casing for gas purging, is not parallel to a plane defined by an optical axis of said at least one lens and a straight line connecting another adjacent pair of said plurality of passage means" which is believed to provide a proper recitation of "a same casing". Claim 18 has been similarly amended.

In view of the foregoing, it is believed that Claims 1, 6, 7 and 15 as amended by this amendment fully meet the requirements of 35 U.S.C. § 112, second paragraph.

Claims 1, 2, 4-7, 11, 14-16 and 18 have been rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 4,690,528 to Tanimoto, et al. or U.S. Patent No. 5,883,704 to Nishi, et al. With regard to the claims as amended by this amendment, this rejection is respectfully traversed.

Independent Claims 1 and 15 as amended by this amendment are directed to an exposure arrangement in which an illumination optical system illuminates an original with ultraviolet light and a projection optical system projects a pattern of the original onto a substrate to be exposed. A gas purging unit replaces the inside space which accommodates optical components of at least one of the illumination optical system and the projection optical system with a dry gas.

In Applicant's view, Tanimoto, et al. discloses projection exposure apparatus in which a projection lens has a plural number of lens elements that are spaced apart. A gas flow is supplied to at least one of the spaces through which the gas passes. The spaces supplied with gas from the atmosphere are isolated and the refractive index of the isolated spaces is changed.

According to the invention of Claims 1 and 15 as amended by this amendment, an inside space accommodating optical components of an illumination optical system and/or a projection optical system is replaced with a dry gas. Advantageously, the replacement by dry gas is very effective in preventing illuminance degradation caused by deposition of impurities on optical components.

It is a feature of Claims 1 and 15 that an inside space accommodating optical components of an illumination and/or

projection optical system is replaced with a dry gas. Tanimoto, et al. may disclose a projection optical system in which spaces that separate lenses communicate through air holes and in which the inside pressure and inside temperature are measured and controlled. The Tanimoto, et al. disclosure only teaches at lines 41-44 of column 3 that the gas supplied is taken from external atmosphere or teaches at lines 53-56 of column 6 that the gas supplied is from a filtered air supply. Tanimoto, et al., however, fails in any manner to suggest that the type of gas supplied is a dry gas that replaces the inside space of an illumination or projection optical system accommodating optical components as in Claims 1 and 15. It is therefore believed that Claims 1 and 15 as amended by this amendment are completely distinguished from Tanimoto, et al..

In Applicant's opinion, Nishi, et al. discloses a projection optical system having plural glass optical members at least one of which has a temperature characteristic of index of refraction different from the other glass material. A temperature control device controls the temperature of at least one of the optical members and an imaging characteristic of the projection optical system is controlled. The imaging characteristic to be controlled is a non-linear magnification or curvature of field. The temperature control device sets the temperature to be controlled to be a variable target temperature

determined according to the imaging characteristic of the projection optical system. An exposure operation to transfer a mask pattern to a photosensitive substrate is started after the temperature of the optical member to be controlled reaches a predetermined allowable range of the target temperature.

Nishi, et al. may show in Figs. 1 and 2 supplying a temperature controlled gas to a projection optical system and controlling the pressure between lens elements in the projection optical system. The gas supplied to the projection optical system as disclosed at lines 50-53 of column 11 of Nishi, et al. is a temperature controlled gas. The Nishi, et al. arrangement, however, fails to suggest in any way the feature of Claims 1 and 15 that a dry gas replaces the inside space of an illumination optical system and/or a projection optical system that accommodates optical components. As a result, it is believed that Claims 1 and 15 are completely distinguished from Nishi, et al.

Independent Claims 14 and 18 as amended are directed to an exposure apparatus in which an illumination optical system that illuminates an original and a projection optical system projects a pattern of the original onto a substrate to be exposed. A gas purging unit replaces an inside space which contains optical components of at least one of the illumination optical system and the projection optical system with a

particular gas. The optical components include at least one lens. Plural passage units mutually communicate spaces separated by the optical components to assist in gas purging by the gas purging unit. A straight line connecting an adjacent pair of the plural passage units provided in the same casing for gas purging is not parallel to a plane defined by an optical axis of the at least one lens and a straight line connecting another adjacent pair of plural passage units.

It is a feature of Claims 14 and 18 that a straight line connecting an adjacent pair of plural passage means that mutually communicate among spaces separated by optical components in a casing for gas purging is not parallel to a plane defined by the optical axis of the lenses and a straight line connecting another adjacent pair of plural passage means. Advantageously, the shifting of the passage means that places them out of a common plane with the optical axis greatly increases the efficiency gas supply and substantially improves design freedom in structure formation.

Tanimoto, et al. in Fig. 7 may show plural passage units in a common casing. Straight lines connecting the passage units in Tanimoto, et al., however, are all in one common plane. In contrast to Tanimoto, et al.'s straight line between adjacent passage units in a common plane, the passage units of Claims 14 and 18 are arranged so that the straight lines connecting

adjacent passage units are arranged to be in different planes so that the efficiency of gas purging is increased along with the flexibility in design of the optical systems is expanded. Accordingly, it is not seen that Tanimoto, et al. in any manner teaches the features of Claims 14 and 18 as amended.

As discussed with respect to Tanimoto, et al., it is a feature of Claims 14 and 18 that a straight line connecting an adjacent pair of plural passage means in a same casing for gas purging, is not parallel to a plane defined by an optical axis of the lens therein and a straight line connecting another adjacent pair of the plural passage means. Nishi, et al. may show supplying temperature controlled gas into a projection optical system. As shown in Fig. 2 of Nishi, et al., the straight lines between passageways conveying gas between lenses in the casing are all in one plane. Accordingly, Nishi, et al. fails to teach or suggest the shifting arrangement of passage means of Claims 14 and 18 which provides a high efficiency gas supply. Accordingly, it is believed that Claims 14 and 18 are completely distinguished from Nishi, et al..

Pending independent Claims 6 and 16 are directed to an exposure arrangement in which an illumination optical system illuminates an original with ultraviolet light and a projection optical system projects a pattern of the original onto a substrate to be exposed. A gas purging unit replaces an inside

space which contains optical components of at least one of the illumination optical system and the projection optical system with a particular gas. The optical components includes at least one lens. A passage unit mutually communicates spaces separated by the optical components to assist in gas purging by the gas purging unit. A support supports the at least one lens and the passage unit includes an aperture formed in the support. A straight line connecting apertures of a pair of adjacent supports of the passage units is not parallel to a plane defined by an optical axis of a lens that is one of the optical components and a straight line connecting apertures of another pair of adjacent supports.

Claims 6 and 16 as amended by this amendment include the feature of a straight line connecting apertures of one pair of adjacent supports of passage units not being parallel to a plane defined by an optical axis of a lens of the optical components and a straight line connecting apertures of another pair of supports. As discussed with respect to Claims 14 and 18, neither Tanimoto, et al. nor Nishi, et al. in any manner suggest this feature of Claims 6 and 16. It is a further feature of Claims 6 and 16 that gas purging means replaces an inside space containing optical components with a particular gas (e.g., N₂, He or dry air). Tanimoto, et al. is restricted to teaching that the gas supplied is taken from external atmosphere or to teaching

that the gas supplied is from a filtered air supply.

Accordingly, it is not seen that Tanimoto, et al. in any manner teaches or suggests replacing inside space with a particular gas as in Claims 6 and 16.

Nishi, et al. may teach supplying a temperature controlled gas into a projection optical system. The Nishi, et al. arrangement fails to teach or suggest the feature of Claims 6 and 16 of a lens support having an aperture formed therein as part of a passage means for gas purging. Accordingly, it is not seen that Nishi, et al. in any way suggests the features of Claims 6 and 16.

Claims 1 through 3 have been rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 4,786,947 to Kosugi, et al..

In Applicant's view, Kosugi, et al. discloses a projection exposure apparatus in which a chamber houses a reticle, a wafer and a projection optical system in a closed space. Detectors detect a temperature and a pressure of a gas in the space and an adjusting unit adjusts the temperature and pressure of the gas in the chamber from outside the chamber. The adjusting unit is controlled on the basis of the detection so that the temperature and pressure of the gas in the space are regulated to be best suited to retain predetermined optical performance of the projection optical system.

Kosugi, et al. may teach a casing accommodating an optical system, a humidity sensor and purging means to control temperature or pressure of gas circulated in the casing. Kosugi, et al., however, is devoid of any disclosure of supplying dry gas into a casing holding an optical system. Further, Kosugi, et al. uses a humidity sensor that monitors change of humidity in the optical system casing to control the inside pressure for focus position distortion correction or magnification of the optical system.

In contrast to Kosugi, et al., it is a feature of Claim 1 that gas purging means replaces an inside space, which accommodates optical components of the illumination optical system and/or said projection optical system, with a dry gas to prevent deposition of impurities on optical components. At lines 49-52 of column 1 of Kosugi, et al., it is clearly disclosed that precise control of humidity is not necessary since the influence of humidity on optical performance is small. Accordingly, it is not seen that Kosugi, et al. could possibly suggest the feature of replacing an inside space accommodating optical components with a dry gas. Accordingly, Claim 1 as amended is believed to be completely distinguished from Kosugi, et al..

Claims 1, 4-8, 11, 12, 14-16 and 18 have been rejected under 35 U.S.C. § 103 as being unpatentable over U.S.

Patent No. 5,696,623 to Fujie, et al. in view of the Nishi, et al. patent.

In Applicant's opinion, Fujie, et al. discloses a UV exposure apparatus in which openings are formed in the wall of a lens barrel to allow the atmosphere to be replaced by a proper gas (e.g., a gas not containing oxygen such as nitrogen, or clean air obtained by applying ultraviolet light to source air).

With regard to Claims 1 and 15 as amended by this amendment, Fujie, et al. may teach replacing an atmosphere with nitrogen gas or clean air but fails to suggest any arrangement that supplies dry air to replace an atmosphere. Nishi, et al. as aforementioned, may teach supplying a temperature controlled gas but fails to suggest replacing inside space with dry gas. Accordingly, it is not seen that any combination of Fujie, et al. and Nishi, et al. in any way suggests the features of Claims 1 and 15. As a result, it is believed that Claims 1 and 15 are completely distinguished from any combination of Fujie, et al. and Nishi, et al. and are allowable.

In regard to Claims 6 and 16, neither Fujie, et al. nor Nishi, et al. teach or suggest the feature of Claims 6 and 16 of passage means mutually communicating spaces separated by optical components to assist gas purging. It is a further feature of Claims 6 and 16 that the passage means includes an aperture in a support for at least one lens. Both the Fujie, et

al. and the Nishi, et al. disclosures are devoid of any suggestion of an aperture of a passage means mutually communicating spaces being formed in a lens support as in Claims 6 and 16. Additionally, neither of these references suggest straight lines between apertures in support being in different planes. Accordingly, it is believed that pending Claims 6 and 16 are completely distinguished from any combination of Fujie, et al. and Nishi, et al. and are allowable.

As to Claims 14 and 18, Fujie, et al. has been cited as teaching a straight line connecting adjacent passage means provided in the casing extends out of parallel to an optical axis of the lens. Fujie, et al., however, only discloses that all straight lines are in a common plane. It is a feature of Claims 14 and 18 that a straight line connecting an adjacent pair of said plurality of passage means provided in a same casing for gas purging, is not parallel to a plane defined by an optical axis of said at least one lens and a straight line connecting another adjacent pair of said plurality of passage means. Accordingly, a straight line connecting one pair adjacent passage means is in a different plane than straight line connecting another pair of adjacent passage means. Further Fujie, et al. does not teach the use of dry gas and Fujie, et al. only shows bores Ha through Hd that communicate with between spaces and outside pipes Pin and Pout. Similarly, Nishi, et al. only teaches pipings (19, 20)

that communicate between spaces and outside pipes and fails in any manner to suggest connecting serially connecting adjacent passage means in different planes as in Claims 14 and 18.

Accordingly, it is not seen that any combination of Fujie, et al. and Nishi, et al. could possibly suggest the features of Claims 14 and 18 as amended by this amendment and are allowable.

A review of the other art of record has failed to reveal anything which, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record. Applicant submits that the amendments to independent Claims 1, 6, 14, 15, 16 and 18 clarify Applicant's invention and serve to reduce any issues for appeal.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application. The Examiner

is respectfully requested to enter this Amendment After Final Rejection under 37 C.F.R. § 1.116.

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Respectfully submitted,



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